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(54) **Staged shooting pot for injection molding.**

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Description

BACKGROUND OF THE INVENTION

The present invention relates to an injection molding apparatus according to the preamble of claim 1, and to a method for injection molding according to the preamble of claim 7.

The use of control units such as shooting pots to introduce thermoplastic resin into mold cavities in an injection molding system is well known. In such arrangements a primary resin source feeds the reservoir of a shooting pot and the shooting pot in turn is operated to feed a measured or metered quantity of thermoplastic material into the mold cavity.

It is also known to supply thermoplastic material to a multicavity mold where the cavities of the mold are fed by a hot runner system and where the hot runner system includes a plurality of shooting pots, with at least one each individual to each molding cavity. That is, a source of thermoplastic material leads to the hot runner system which in turn feeds the respective mold cavities wherein a shooting pot or metering means is provided for each mold cavity for controlling precisely the introduction of a shot of resin to the mold cavity. U.S. Patents 4,717,324 and 4,775,308, upon which the preambles of claims 1 and 7 are based, teach the coinjection of a plurality of thermoplastic materials to mold an article having a layered wall structure using thermoplastic materials having different optimum processing temperatures including the maintenance of the optimum temperatures in flow paths individual to each material from its source to a mold cavity. These patents show shooting pots used in conjunction with the formation of the layered wall structure and multicavity molding. However, these disclosures involve the use of shooting pots to individually meter the amount of the first feeding of a first resin and the first feeding of a second resin into each cavity of a multicavity mold. In all cases, however, the final feeding and packing of the cavity is achieved by pressurizing the extruder or injection unit used to supply the final feeding resin to all the cavities in the mold. Thus, the hot runner supply channel system must be carefully balanced between the extruder or injection unit and each cavity gate or cavity orifice of the multicavity mold. In case of a large number of mold cavities, such as 32 or 48, this becomes quite impractical to achieve.

Accordingly, it is a principal object of the present invention to provide an injection molding method and apparatus for feeding a supply of thermoplastic material to a mold cavity from a shooting pot which can effectively eliminate the need for packing by the extruder or injection unit.

It is a further object of the present invention to provide a method and apparatus as aforesaid which is suitable for use with an injection molding apparatus including a large number of cavities.

Further objects and advantages of the present invention will appear hereinbelow.

SUMMARY OF THE INVENTION

In accordance with the present invention, the foregoing objects and advantages can be readily achieved.

The method for injection molding of the present invention comprises the sequential steps of : feeding a supply of thermoplastic material to a shooting pot from a supply of thermoplastic material via a hot runner system; delivering a first charge of thermoplastic material from the shooting pot to a mold cavity; and delivering a second charge of thermoplastic material to the mold cavity; and is characterised in that said second charge is delivered from said shooting pot. The shooting pot maintains injection pressure or packing pressure on the mold cavity to pack or complete filling of the mold cavity and overcome shrinkage. Preferably also, a multicavity molding system is provided with a plurality of shooting pots, each individual to each mold cavity.

The injection molding apparatus of the present invention comprises: at least one mold cavity; a hot runner system for supplying thermoplastic material to said mold cavity; supply means for supplying said thermoplastic material to said hot runner system; a shooting pot operative to hold a given amount of thermoplastic material communicating with the hot runner system and supplied thereby; a first valve means between the supply means and the shooting pot, generally in the hot runner system, and a second valve means between the shooting pot and the mold cavity, both of said valve means being operative to permit and block flow of thermoplastic material; injection means communicating with said shooting pot; and is characterised in that said injection means comprise a first injection means for delivery of a first charge of thermoplastic material from said shooting pot to said mold cavity; and a second injection means communicating with said shooting pot for delivery of a second charge of thermoplastic material from the shooting pot to the mold cavity. The second injection means is provided with means for maintaining a supply of thermoplastic material from the shooting pot to the mold cavity in order to pack or fill the mold cavity and overcome shrinkage of thermoplastic material.

In the preferred embodiment, a second hot runner system is provided for supplying a second thermoplastic material to the mold cavity, second supply means for supplying said second thermo-

plastic material to said second hot runner system, a second shooting pot operative to hold a given amount of the second thermoplastic material communicating with the second hot runner system and supplied thereby, a third and fourth valve means operative to permit and block flow of thermoplastic material, and a third injection means communicating with the second shooting pot for delivering a charge of the second thermoplastic material to the mold cavity.

Preferably also a plurality of mold cavities are provided with one or more shooting pots individual to each mold cavity.

Thus, in accordance with the present invention, it is not necessary for the supply means or extruder to make the final feeding. The final feeding of thermoplastic material to each mold cavity can be achieved by a shooting pot, e.g., the same shooting pot that made the first feeding. This obviates the need to provide a balanced hot runner system between the machine's extruder or injection unit and each cavity. Consequently, a simpler design is provided and complicated hot runner construction is eliminated. Moreover, in accordance with the present invention, it now becomes practical to construct multicavity molds exceeding 24 cavities.

Further objects and advantages of the present invention will appear hereinbelow.

BRIEF DESCRIPTION OF THE DRAWINGS

The present invention will be more readily understandable from a consideration of the appended drawings wherein:

Figure 1 is a schematic drawing showing the injection system of the present invention fully charged with a resin;

Figure 2 is similar to Figure 1 showing the first stage injection having been completed;

Figure 3 is similar to Figure 1 showing the second stage injection having been completed;

Figure 4 shows a two stage shooting pot in combination with a single stage shooting pot for supplying at least two different resins to the same cavity; and

Figure 5 is a schematic illustration of the system and method of the present invention for a four cavity mold accommodating two thermoplastic resins with each mold utilizing the system of Figure 4.

DETAILED DESCRIPTION

Figures 1-3 show a representative embodiment of the present invention. For ease of understanding Figures 1-3 show a single mold cavity; however, it should be appreciated that a plurality of mold cavities may be fed by a single extruder with each mold cavity including at least one shooting pot associated therewith. Figure 1 shows the injection system fully charged, Figure 2 shows the first stage injection completed, and Figure 3 shows the second stage injection completed. Referring to Figure 1, mold cavity 10 is supplied with thermoplastic material via hot runner system 11, leading from a source or supply means of thermoplastic material, such as extruder 12. Shooting pot or injection cylinder 13 communicates with hot runner system 11 and is supplied thereby. Both the shooting pot 13 and hot runner system 11 are located in manifold 14 which may be provided with appropriate heating means to maintain the resin in the hot runner system and in the shooting pot at an appropriate temperature, all in a customary manner. Injection nozzle 15 is provided leading from hot runner system 11 and communicating with mold cavity 10, also in a customary manner, including customary valve gate (not shown).

A first valve means 20 is provided in hot runner system 11 between shooting pot 13 and supply means 12, and a second valve means 21 is provided in hot runner system 11 between mold cavity 10 and shooting pot 13, both of said valve means being operative to permit and block flow of thermoplastic material in the hot runner system. Figure 1 shows the first valve means 20 open to permit flow of resin from extruder 12 to shooting pot 13, and the second valve means closed to prevent flow of resin to the mold cavity 10.

Shooting pot 13 is filled from supply means 12 via hot runner system 11 with valve 20 open and valve 21 closed as shown in Figure 1. In the filled condition the shooting pot contains a volume equal to V_1 and V_2 which is equivalent to the first charge of resin to the mold cavity (V_1) plus the second charge of resin to the mold cavity (V_2). The shooting pot can be discharged to supply resin to the mold cavity via hot runner system 11 with first valve means 20 closed to block back-flow of resin and second valve means 21 open, as shown in Figures 2 and 3. Thus, as shown for example in Figure 2, first valve means 20 is closed to block flow of resin to the supply means and second valve means 21 is open to permit flow of resin to mold cavity 10.

Shooting pot 13 includes injection piston 22 actuated by injection pad 23. A first stage injection piston 24 situated in first injection cavity 25 in machine platen 30 (or alternately in mold base) operates first injection rod 26, which in turn actuates a second stage injection piston 27 situated in second injection cavity 28. The second stage piston 27 operates a second injection rod 29 which in turn actuates pad 23. In the fully charged position shown in Figure 1, piston 22, pad 23 and

pistons 24 and 27 are in the fully retracted position.

A high pressure fluid is supplied to one side of first stage injection piston 24 via supply line 31 from a suitable pressure source (not shown) to advance piston 24 and rod 26. Rod 26 pushes against second stage piston 27 and rod 29 which in turn pushes against pad 23. Piston 24 advances until it bottoms out at the end of its stroke against cylinder end of cavity 25. The shooting pot piston 22 has advanced a distance A and displaced a corresponding volume of resin V_1 into mold cavity 10 with the apparatus now in the position shown in Figure 2.

As shown in Figure 3, the second stage injection takes place after the first stage injection when a high pressure fluid is supplied to one side of second stage injection piston 27 via supply line 32 from a suitable pressure source (not shown) to further advance piston 27. Piston 27 in turn further advances rod 29 which in turn advances pad 23 and rod 22 to displace a corresponding volume of resin V_2 into mold cavity 10 via nozzle 15. Unlike the first stage, however, piston 27 does not bottom out at the cylinder end of cavity 28, but continues to maintain hold pressure against the piston to continue to pressurize the resin and to continue to supply more resin to the mold cavity during the hold stage or packing stage of the cycle. As the resin in the mold cavity shrinks more resin is supplied thereto from the shooting pot via pressure maintained on piston 27 to make up the shrinkage until the cycle is complete and the shooting pot piston has advanced a final distance B. Piston 27 may then bottom out against cylinder end of cavity 28 as shown in Figure 3.

When the injection and hold stages of the cycle are complete valve means 21 is closed and valve means 20 is opened and the shooting pot is recharged with resin. The incoming resin pushes back the shooting pot piston 22, pad 23 and associated first and second stage pistons until the first stage piston 24 contacts volume adjusting means 33 which adjusts the stroke of the first and second injection means and the volume charged in the shooting pot. This is shown in Figures 1-3 as an adjustable threaded rod against which first piston 24 contacts; however, any suitable means to adjust the volume of the resin delivered in the first and second injection steps may be employed. Thus, a preset volume of resin is charged in the shooting pot because of the preset stroke of piston 24 and associated back position of piston 27. Hence, preset volume V_1 (first shot) can be discharged and a second volume V_2 can be discharged (second shot) to fill and pack out the part in the mold cavity.

The molded part is ejected from the mold cavity and the cycle is repeated.

A particular application of the present invention is in the coinjection of multilayered articles, such as for example preforms. Figure 4 shows a preferred embodiment, wherein it should be appreciated that a plurality of mold cavities may be employed, with each mold cavity having two or more shooting pots associated therewith and with the entire system fed by at least two extruders (one for each resin).

Figure 4 shows a mold hot runner system having two sets of shooting pots and associated pistons for moving them. The first resin system utilizes a system as shown in Figures 1-3 with like reference numerals employed for like components. The second resin system utilizes hot runner system 50 communicating with a supply of second resin as from a suitable extruder and communicating with mold cavity 10 via nozzle 15. Second shooting pot 51 operative to hold a given amount of second resin communicates with hot runner system 50 and supplied thereby. Third and fourth valve means 58 and 59 are provided on hot runner system 50 operative to permit and block flow of the second thermoplastic material in the same manner as first and second valve means 20 and 21. Second shooting pot 51 is operated by injection piston 52 actuated by injection pad 53 which in turn is actuated by piston 54 and rod 55. Volume adjusting means 56 is provided associated with piston 54 similar to volume adjusting means 33. High pressure fluid is supplied to one side of piston 54 via supply line 57 from a suitable pressure source (not shown).

Thus, in operation, the shooting pots are charged with resin by closing valve means 21 and 58 and opening valve means 20 and 59 as shown in Figure 4 with the system fully charged. Valve means 20 and 59 are then closed to block the supply channels to the shooting pots. Valve means 21 is opened. High pressure fluid is supplied to first shot piston 24 to displace first volume V_1 of first resin into mold cavity 10 via channel 11 and nozzle 15.

Valve means 21 is then closed, valve means 58 opened and high pressure fluid is supplied to piston 54 for a first shot of a second resin to advance piston 54 and its associated shooting pot piston 52 to displace a preset volume V_2 of resin into mold cavity 10 via channel 50 and nozzle 15.

Valve means 58 is then closed and valve means 21 opened again. High pressure fluid is supplied to third shot piston 27 to displace its shooting pot piston 22 for a second feeding of the first resin into mold cavity 10 via channel 11 and nozzle 15 until the mold cavity is filled. Piston 27 maintains hold pressure to fill and pack mold cavity 10 as in Figures 1-3.

Valve means 21 is then closed and valve means 20 and 59 opened to recharge both shooting pots at the same time for the next cycle, the molded part is removed and the cycle repeated.

The sequence described above with respect to Figure 4 is for sequential injection of three feedings of two resins which will form a five layered wall structure in the molded part. The final feeding of the first resin includes the packing or holding step to fill the mold and compensate for shrinkage.

As indicated hereinabove, the present invention is particularly suitable to simultaneous molding of a plurality of parts, such as for example 16, 24, 32 or 48 parts. This is shown schematically in Figure 5 for four parts using two resins in a manner similar to Figure 4. In Figure 5, extruder A feeds the first resin shorn in solid lines and extruder B feeds the second resin shown in dashed lines. Molds 110 are fed by hot runner systems 111 and 150 similar to hot runner systems 11 and 50 respectively. Shooting pots 113 and 151 are provided similar to shooting pots 13 and 51 in Figure 4. Thus, each mold cavity 110 has an associated first shooting pot 113 for the first resin and associated second shooting pot 151 for the second resin. Appropriate valve means are provided in the hot runner systems in a manner after Figure 4. Thus, it can be readily seen that a plurality of mold cavities may be fed from a single extruder for each resin with one or more shooting pots associated with each mold cavity for feeding resin to the mold cavity including filling and packing thereof by the shooting pots.

It can be readily seen that the method and apparatus of the present invention achieves significant advantages. The shooting pot system achieves a staggered injection cycle including a metered first charge followed by a second charge from the same source individual to each mold cavity. This provides a balanced hot runner system between the machine's extruder or injection unit and each cavity and avoids the considerable complications heretofore involved in constructing large multicavity systems. The present invention is admirably suitable to co-injection and tri-injection molding in multicavity molds obviating complexities of construction and achieving simplified operating systems. Moreover, in view of the fact that all feeding to the mold cavity is handled by the shooting pots, it becomes simpler to control the temperature of each resin individually. This is a highly desirable goal and it is achieved readily and conveniently by the instant system.

It is to be understood that the invention is not limited to the illustrations described and shown herein, which are deemed to be merely illustrative of the best modes of carrying out the invention, and which are susceptible of modification of form, size, arrangement of parts and details of operation.

Claims

1. An injection molding apparatus which comprises: at least one mold cavity (10); a hot runner system (11,111) for supplying thermoplastic material to said mold cavity (10); supply means (12) for supplying thermoplastic material to the hot runner system (11,111); a shooting pot (13,113) operative to hold a given amount of thermoplastic material communicating with the hot runner system (11,111) and supplied thereby; a frist valve means (20) between the supply means (12) and the shooting pot (13,113) and a second valve means (21) between the shooting pot (13,113) and the mold cavity (10), both of said valve means (20,21) being operative to permit and block flow of thermoplastic material; injection means communicating with said shooting pot (13,113); characterised in that said injection means comprise a first injection means (24,25,26) for delivering a first charge of thermoplastic material from the shooting pot (13,113) to the mold cavity (10); and a second injection means (27,28,29) for delivering a second charge of thermoplastic material from the shooting pot (13,113) to the mold cavity (10).

2. An apparatus according to claim 1 wherein said second injection means (27,28,29) includes means for maintaining a supply of thermoplastic material from said shooting pot (13,113) to said mold cavity (10) to fill the mold cavity (10) and overcome shrinkage of thermoplastic material.

3. An apparatus according to claim 1 or 2 including a plurality of molds (110) with mold cavities each of which having an associated shooting pot (113).

4. An apparatus according to one of claims 1 - 3 wherein each mold cavity (10) includes a second hot runner system (50,150) for supplying a second thermoplastic material to the mold cavity (10), second supply means for supplying the second thermoplastic material to the second hot runner system (50,150), a second shooting pot (51,151) operative to hold an given amount of the second thermoplastic material communicating with the second hot runner system (50,150) and supplied thereby, a third valve means (59) between the second supply means and second shooting pot (51,151) and a fourth valve means (58) between the second shooting pot (51,151) and the mold cavity (10), both of said valve means (58,59) operative to permit and block flow of

thermoplastic material, a third injection means (54,55) communicating with said second shooting pot (51,151) for delivery of a measured charge of second thermoplastic material to the mold cavity (10).

5. An apparatus according to at least one of claims 1 - 4 including a hot runner manifold (14) wherein said shooting pot (13,51,113,151) is within the hot runner manifold (14).

6. An apparatus according to at least one of claims 1 - 5 including volume adjusting means (33) associated with the first injection means (24,25,26) to adjust the volume of resin in the shooting pot (13).

7. A method for injection molding comprising the sequential steps of: feeding a supply of thermoplastic material to a shooting pot (13,113) from a supply (12) of thermoplastic material via a hot runner system (11,111) delivering a first charge of thermoplastic material from the shooting pot (13,113) to a mold cavity (10); and delivering a second charge of thermoplastic material to the mold cavity (10), characterised in that said second charge is delivered from said shooting pot.

8. A method according to claim 7 including the step of maintaining injection pressure on the mold cavity (10) via the shooting pot (13,113) in order to fill the mold cavity (10) and overcome shrinkage of thermoplastic material.

9. A method according to claim 7 or 8 including the steps of providing a plurality of molds (113) with mold cavities each of which having an associated shooting pot (113) and simultaneously filling each mold cavity from each shooting pot (113).

10. A method according to one of claims 7 - 9 including the step of terminating the feeding of the supply (12) of thermoplastic material to the shooting pot (13,113) after a measured charge of resin has been fed to the shooting pot (13,113).

11. A method according to at least one of claims 7 - 10 including the step of providing a second shooting pot (51,151) associated with the mold cavity (10) and delivering a second thermoplastic material to the mold cavity (10) from the second shooting pot (51,151).

12. A method according to claim 11 including the steps of a first delivery of resin to the mold cavity (10) from the first shooting pot (13,113), a second delivery of resin to the mold cavity from the second shooting pot (51,151) and a final delivery of resin to the mold cavity (10) from the first shooting pot (13,113).

Patentansprüche

1. Spritzformvorrichtung mit zumindest einem Formraum (10), einem Heisskanalsystem (11, 111) zum Zuführen von thermoplastischem Material zu dem Formraum (10), einer Beschikkungseinrichtung (12) zum Zuführen von thermoplastischem Material in das Heisskanalsystem (11, 111), einem Spritztopf (13, 113) zur Aufnahme einer vorgegebenen Menge an thermoplastischem Material, welcher mit dem Heisskanalsystem (11, 111) verbunden ist und von diesem bebeschickt wird, einer ersten Ventileinrichtung (20) zwischen der Beschikkungseinrichtung (12) und dem Spritztopf (13, 113) und einer zweiten Ventileinrichtung (21) zwischen dem Spritztopf (13, 113) und dem Formraum (10), wobei beide Ventileinrichtungen (20, 21) betätigbar sind, um einen Fluss von thermoplastischem Material zu erlauben oder zu blockieren, und einer Einpresseinrichtung, welche mit dem Spritztopf (13, 113) verbunden ist,
dadurch gekennzeichnet,
dass die Einpresseinrichtung eine erste Einspritzeinrichtung (24, 25, 26) zum Zuführen einer ersten Charge von thermoplastischen Material von dem Spritztopf (13, 113) zu dem Formraum (10) und eine zweite Einspritzeinrichtung (27, 28, 29) zum Zuführen einer zweiten Charge von thermoplastischem Material von dem Spritztopf (13, 113) zu dem Formraum (10) aufweist.

2. Vorrichtung nach Anspruch 1, dadurch gekennzeichnet, dass die zweite Einspritzeinrichtung (27, 28, 29) eine Einrichtung zum Aufrechterhalten einer Zufuhr von thermoplastischem Material von dem Spritztopf (13, 113) zu dem Formraum (10) aufweist, um den Formraum (10) aufzufüllen und eine Schrumpfung (Volumenverminderung) von thermoplastischem Material auszugleichen.

3. Vorrichtung nach Anspruch 1 oder 2, dadurch gekennzeichnet, dass eine Mehrzahl von Formen (110) mit Formräumen vorgesehen ist, wobei jedem ein Spritztopf (113) zugeordnet ist.

4. Vorrichtung nach einem der Ansprüche 1 - 3, dadurch gekennzeichnet, dass jedem Form-

raum (10) ein zweites Heisskanalsystem (50, 150) zum Zuführen eines zweiten thermoplastischen Materials zu dem Formraum (10), eine zweite Beschickungseinrichtung zum Zuführen des zweiten thermoplastischen Materials zu dem zweiten Heisskanalsystem (50, 150), ein zweiter Spritztopf (51, 151) zum Aufnehmen einer vorgegebenen Menge an zweitem thermoplastischem Material, welches mit dem zweiten Heisskanalsystem (50, 51) verbunden ist und von ihm versorgt wird, eine dritte Ventileinrichtung (59) zwischen der zweiten Beschickungseinrichtung und dem zweiten Spritztopf (51, 151) und eine vierte Ventileinrichtung (58) zwischen dem zweiten Spritztopf (51, 151) und dem Formraum (10), wobei beide Ventileinrichtung (58, 59) dazu geeignet sind, den Fluss von thermoplastischem Material zu erlauben oder zu blockieren, und eine dritten Einspritzeinrichtung (54, 55), welche mit dem zweiten Spritztopf (51, 151) zum Zuführen einer vorbestimmten Menge an zweitem thermoplastischem Material zu dem Formraum (10) verbunden ist, zugeordnet ist.

5. Vorrichtung nach zumindest einem der Ansprüche 1 - 4, gekennzeichnet durch einen Heisskanalverteilerblock (14), wobei der Spritztopf (13, 51, 113, 151) sich in dem Heisskanalverteilerblock (14) befindet.

6. Vorrichtung nach wenigstens einem der Ansprüche 1 - 5, gekennzeichnet durch eine Volumeneinstelleinrichtung (33), welche der ersten Einspritzeinrichtung (24, 25, 26) zugeordnet ist, um das Volumen von Harz in dem Einspritztopf (13) einzustellen.

7. Verfahren zum spritzformen, welches die aufeinanderfolgenden Stufen einer Zuführung einer Menge von thermoplastischem Material zu einem Spritztopf (13, 113) von einer Beschikkungseinrichtung (12) für thermoplastisches Material über ein Heisskanalsystem (11, 111); ein Liefern einer ersten Charge von thermoplastischem Material von dem Spritztopf (13, 113) zu einem Formraum (10) und ein Liefern einer zweiten Charge von thermoplastischem Material zu dem Formraum (10) umfasst, dadurch gekennzeichnet, dass die zweite Charge von diesem Spritztopf zugeführt wird.

8. Verfahren nach Anspruch 7, gekennzeichnet durch eine Verfahrensstufe der Aufrechterhaltung eines Einspritzdruckes in dem Formraum (10) über den Spritztopf (13, 113), um den Formraum (10) zu füllen und eine Schrumpfung des thermoplastischen Materials auszugleichen.

9. Verfahren nach Anspruch 7 oder 8, dadurch gekennzeichnet, dass eine Mehrzahl von Formen (113) mit Formräumen vorgesehen wird, wobei jedem ein Spritztopf (113) zugeordnet und jeder Formraum von jedem Spritztopf (113) gleichzeitig gefüllt wird.

10. Verfahren nach einem der Anprüche 7 - 9, dadurch gekennzeichnet, dass die Zuführung von thermoplastischem Material von der Beschickungseinrichtung (12) zu dem Spritztopf (13, 113) beendet wird, nachdem eine vorbestimmte Menge an Harz dem Spritztopf (13, 113) eingegeben worden ist.

11. Verfahren nach wenigstens einem der Ansprüche 7 - 10, dadurch gekennzeichnet, dass ein zweiter Spritztopf (51, 151) vorgesehen wird, der dem Formraum (10) zugeordnet ist, und dass ein zweites thermoplastisches Material von dem zweiten Spritztopf (51, 151) zu dem Formraum (10) geführt wird.

12. Verfahren nach Anspruch 11, gekennzeichnet durch eine erste Zuführung von Harz zu dem Formraum (10) von dem ersten Spritztopf (13, 113), eine zweite Zuführung von Harz zu dem Formraum von dem zweiten Spritztopf (51, 151) und eine letzte Zuführung von Harz zu dem Formraum (10) von dem ersten Spritztopf (13, 113).

Revendications

1. Appareil de moulage par injection comprenant : au moins une cavité de moule (10) ; un système de coulée à chaud (11, 111) destiné à fournir une matière thermoplastique à la cavité de moule (10) ; un moyen d'alimentation (12) destiné à fournir la matière thermoplastique au système de coulée à chaud (11, 111) ; un pot de transfert (13, 113) servant à maintenir une quantité donnée de matière thermoplastique en communication avec le système de coulée à chaud (11, 111) en étant alimenté par ce système ; un premier moyen de vanne (20) entre le moyen d'alimentation (12) et le pot de transfert (13, 113) et un second moyen de vanne (21) entre le pot de transfert (13, 113) et la cavité de moule (10), les deux moyens de vannes (20, 21) servant à permettre et à bloquer le débit de matière thermoplastique ; et des moyens d'injection communiquant avec le pot de transfert (13, 113) ; caractérisé en ce que les moyens d'injection comprennent un premier moyen d'injection (24, 25, 26) destiné

à délivrer à la cavité de moule (10) une première charge de matière thermoplastique provenant du pot de transfert (13, 113) ; et un second moyen d'injection (27, 28, 29) destiné à délivrer à la cavité de moule (10) une seconde charge de matière thermoplastique provenant du pot de transfert (13, 113).

2. Appareil selon la revendication 1, caractérisé en ce que le second moyen d'injection (27, 28, 29) comprend un moyen permettant de maintenir une alimentation de matière thermoplastique provenant du pot de transfert (13, 113), vers la cavité de moule (10) pour remplir cette cavité de moule (10) et empêcher un retrait de la matière thermoplastique.

3. Appareil selon l'une quelconque des revendications 1 et 2, caractérisé en ce qu'il comprend plusieurs moules (110) munis de cavités de moule comportant chacune un pot de transfert associé (113).

4. Appareil selon l'une quelconque des revendications 1 à 3, caractérisé en ce que chaque cavité de moule (10) comprend un second système de coulée à chaud (50, 150) destiné à fournir une seconde matière thermoplastique à la cavité de moule (10), un second moyen d'alimentation destiné à fournir la seconde matière thermoplastique au second système de coulée à chaud (50, 150), un second pot de transfert (51, 151) servant à maintenir une quantité donnée de la seconde matière thermoplastique en communication avec le second système de coulée à chaud (50, 150) en étant alimenté par ce système, un troisième moyen de vanne (59) entre le second moyen d'alimentation et le second pot de transfert (51, 151) et un quatrième moyen de vanne (58) entre le second pot de transfert (51, 151) et la cavité de moule (10), les deux moyens de vannes (58, 59) servant à permettre et à bloquer le débit de matière thermoplastique, un troisième moyen d'injection (54, 55) communiquant avec le second pot de transfert (51, 151) pour délivrer à la cavité de moule (10) une charge mesurée de la seconde matière thermoplastique.

5. Appareil selon l'une au moins des revendications 1 à 4, comprenant une tubulure de coulée à chaud (14), caractérisé en ce que le pot de transfert (13, 51, 113, 151) est placé à l'intérieur de la tubulure de coulée à chaud (14).

6. Appareil selon l'une au moins des revendications 1 à 5, caractérisé en ce qu'il comprend un moyen de réglage de volume (33) associé au premier moyen d'injection (24, 25, 26) pour régler le volume de résine dans le pot de transfert (13).

7. Procédé de moulage par injection comprenant les étapes successives consistant à : fournir à un pot de transfert (13, 113) une alimentation de matière thermoplastique provenant d'une alimentation (12) de matière thermoplastique, par l'intermédiaire d'un système de coulée à chaud (11, 111) ; délivrer à une cavité de moule (10) une première charge de matière thermoplastique provenant du pot de transfert (13, 113) ; et délivrer à la cavité de moule (10) une seconde charge de matière thermoplastique ; caractérisé en ce que la seconde charge est délivrée à partir du pot de transfert.

8. Procédé selon la revendication 7, caractérisé en ce qu'il comprend l'étape consistant à maintenir une pression d'injection sur la cavité de moule (10) par l'intermédiaire du pot de transfert (13, 113), de manière à remplir la cavité de moule (109) et à empêcher le retrait de la matière thermoplastique.

9. Procédé selon l'une quelconque des revendications 7 ou 8, caractérisé en ce qu'il comprend les étapes consistant à utiliser plusieurs moules (113) munis de cavités de moule comportant chacune un pot de transfert associé (113), et a remplir simultanément chaque cavité de moule à partir de chaque pot de transfert (113).

10. Procédé selon l'une des revendications 7 à 9, caractérisé en ce qu'il comprend l'étape consistant à couper l'alimentation de la source (12) de matière thermoplastique vers le pot de transfert (13, 113) après qu'une charge mesurée de résine ait été introduite dans le pot de transfert (13, 113).

11. Procédé selon l'une au moins des revendications 7 à 10, caractérisé en ce qu'il comprend l'étape consistant à utiliser un second pot de transfert (51, 151) associé à la cavité de moule (10), et à délivrer une seconde matière thermoplastique à la cavité de moule (10) à partir du second pot de transfert (51, 151).

12. Procédé selon la revendication 11, caractérisé en ce qu'il comprend les étapes consistant en une première fourniture de résine à la cavité de moule (10) à partir du premier pot de

transfert (13, 113), une seconde fourniture de résine à la cavité de moule à partir du second pot de transfert (51, 151), et une fourniture de résine finale à la cavité de moule (10) à partir du premier pot de transfert (13, 113).

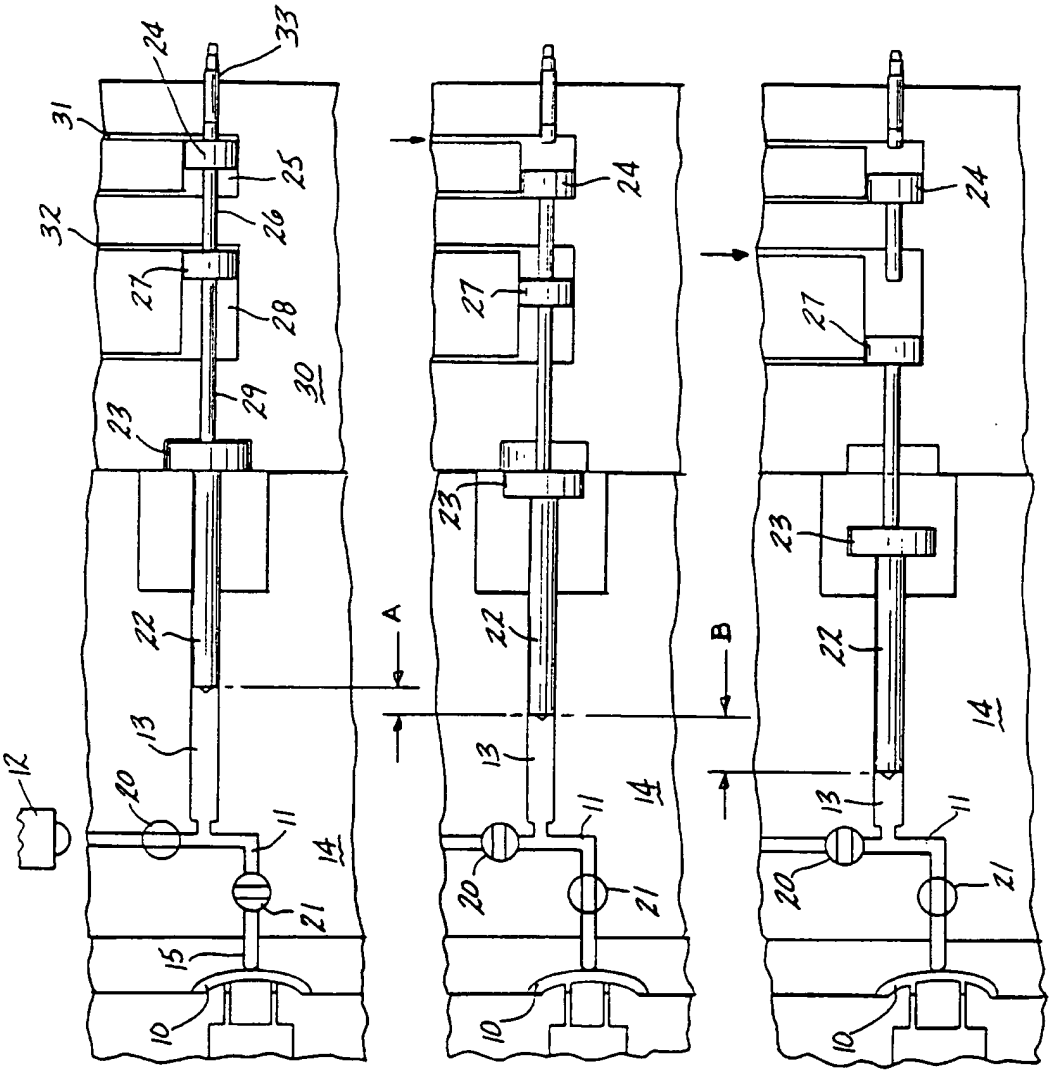

FIG-1

FIG-2

FIG-3

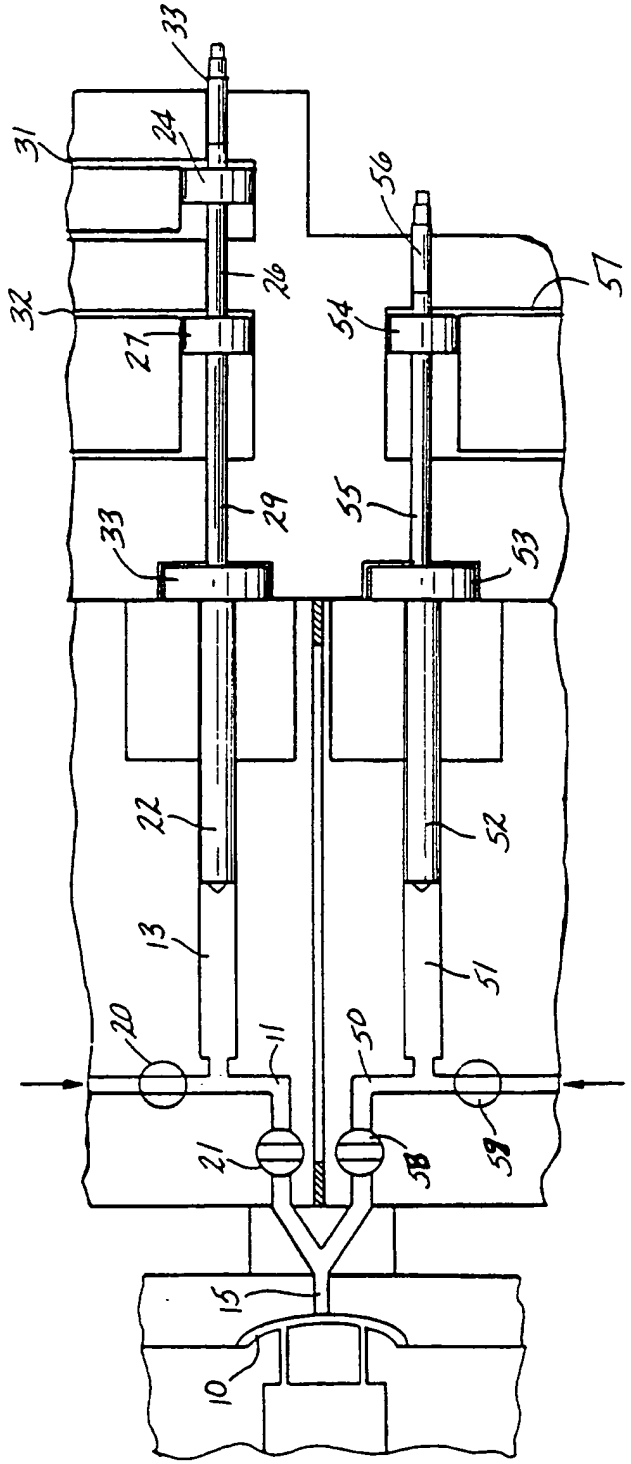
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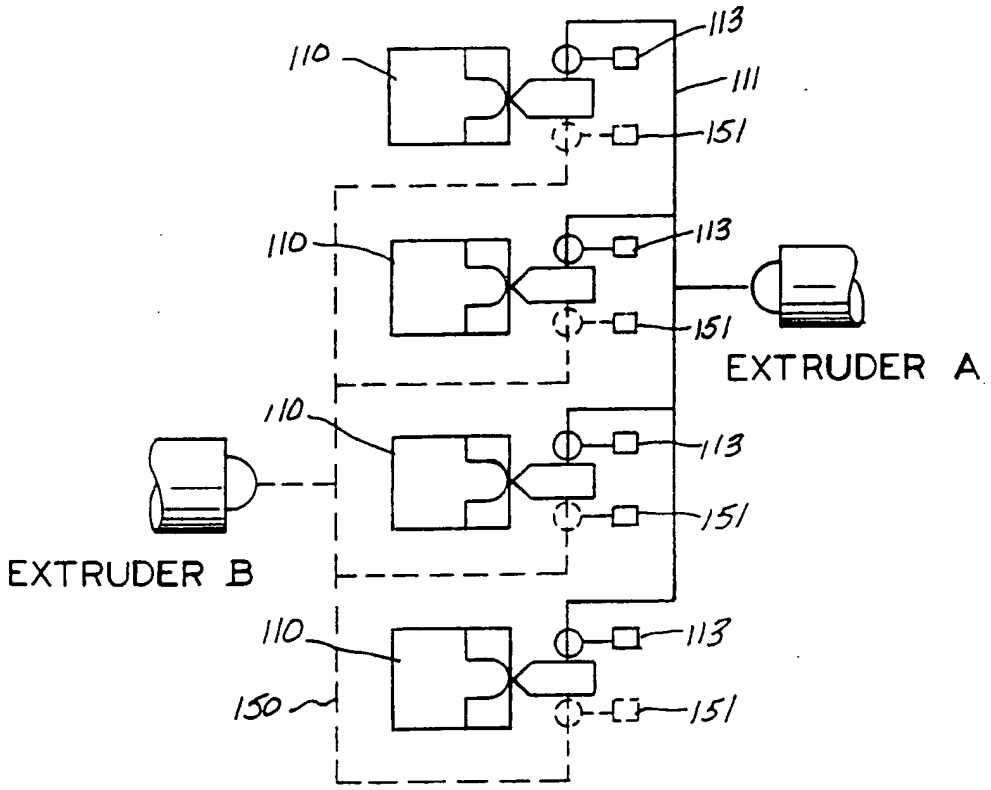
FIG-4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EXTRUDER A
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FIG-5